

TOOLS FOR IMPROVING OPERATIONAL RISK MANAGEMENT IN AGRICULTURE

M.V. Rossinskaya, Doctor of Economic Sciences, Professor,
Sochi State University,
Sovetskaya street 26a, 354000, Sochi city, Krasnodar Krai, Russia
E-mail: rossmv@mail.ru

N. A. Saveleva, Doctor of Economic Sciences, Professor,
Sochi State University,
Sovetskaya street 26a, 354000, Sochi city, Krasnodar Krai, Russia
E-mail: sochi-nelli@yandex.ru

V. V. Rokotyanskaya, Candidate of Economic Sciences, associate professor,
Russian State Agrarian University named after K.A. Timiryazev,
Russia, 127550, Moskow, Timiryazevskaya street, 49,
E-mail: rokotyanskay_v_v@mail.ru

ABSTRACT

The agricultural sector is most subject to the influence of risk factors. This might be explained by the fact that the efficiency and the output of agricultural production depends not only on invested labor and funds, but also on climatic, weather, environmental conditions, natural disasters. In this regard, the development of theoretical foundations of operational risk management in agriculture is highly relevant. The objective of our study was to develop measures to improve the methods of risk assessment and operational risk management at the level of agricultural enterprises, taking into account the requirements of environmental management and environmental protection. The article discusses the conditions and features of agricultural production at the present stage of economic development, gives a comparative description of various sectors of the economy by the presence of risk factors and proposes methods for operational risk management in the agro-industrial complex. An risk management algorithm for agricultural enterprises has been developed.

Keywords: agriculture, risk, management, operational management, food security, agro-industrial complex.

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ادوات تحسين ادارة العمليات التشغيلية في الزراعة

روكوتانسكايا

سوفيتسكايا

ساتيليفا

راسينسكايا

المستخلص

القطاع الزراعي هو الأكثر عرضة لتأثير عوامل الخطر. وقد يفسر ذلك حقيقة أن كفاءة الإنتاج الزراعي ونتاجه لا يعتمدان فقط على اليد العاملة والأموال المستثمرة، بل أيضا على الظروف المناخية والطقس والبيئية والكوارث الطبيعية. في هذا الصدد، فإن تطوير الأسس النظرية لإدارة المخاطر التشغيلية في الزراعة أمر ذو أهمية كبيرة. كان الهدف من البحث وضع تدابير لتحسين أساليب تقييم المخاطر وإدارة المخاطر التشغيلية على مستوى المؤسسات الزراعية، مع الأخذ في الاعتبار متطلبات الإدارة البيئية وحماية البيئة. كما يناقش البحث شروط وميزات الإنتاج الزراعي في المرحلة الحالية من التنمية الاقتصادية، ويقدم وصفاً مقارناً لمختلف قطاعات الاقتصاد من خلال وجود عوامل الخطر ويقترح أساليب لإدارة المخاطر التشغيلية في المجمع الزراعي الصناعي. وقد تم تطوير خوارزمية لإدارة المخاطر للمؤسسات الزراعية

الكلمات المفتاحية: الزراعة، المخاطرة، الإدارة، الإدارة التشغيلية، الامن الغذائي، مجمع الصناعات الزراعية

INTRODUCTION

The problems of ensuring the security of our country in all its forms are quite relevant (11). Food security plays an important role in the country's national security system. It requires the timely identification, objective assessment and effective management of all risks, related to the functioning of Russian agro-industrial complex, the socio-economic position of which still remains contradictory and lags behind its pre-reform level of development. At the same time, agricultural risks are very common throughout the world and stay in the

focus of the attention of governments and decision makers in the field of agricultural policy. However, in Russia, this problem is not getting the attention it deserves.

MATERIALS AND METHODS

The agricultural risks are impossible to avoid, so managing them is an important task for agricultural enterprises. This could be explained, first of all, by the fact that the volume and efficiency of the agricultural production are affected by specific features of this sector (Fig. 1).

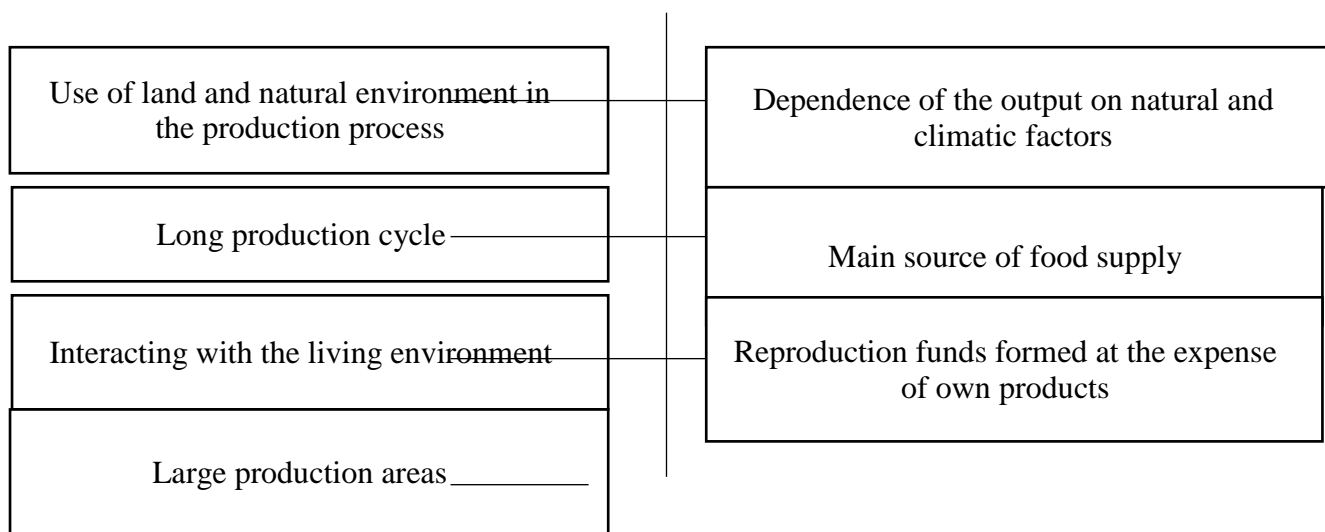


Fig. 1. Specific features of agricultural production

First, the use of land and natural environment is specific to all agricultural activities. In agriculture, the land is the main, indispensable means of production, agricultural output largely depending on its quality, fertility and location. It is thus important to consider this fact when addressing all issues of agricultural development. The land factor is especially important when determining the location of agricultural production and the specialization of farms. Secondly, the agricultural production process is very long and does not coincide with the working period, i.e. it is of seasonal nature. It means that the resources of the enterprise (labor, materials, equipment, etc.) are used unevenly throughout the year, the sales and earnings are irregular, which thus result in an elevated risk of losses. Thirdly, the agricultural output largely depends on natural and climatic conditions. Since rain, drought, frost and other natural phenomena can significantly limit yield, reduce labor

productivity and other indicators, the risks in the agricultural sector are considered to be high. Fourth, agricultural production deals with living organisms. Therefore, the level of its development is influenced not only by economic, but also by biological, chemical laws, which complicates the measurement of the influence of different factors on the results of economic activity. Any instability entails serious consequences for living organisms. The shortage of commercial crop products and fodder leads to a decrease in livestock and its productivity, bringing about risks for livestock farms. Fifthly, the agro-industrial complex is the most important component of the Russian economy: here, a huge economic potential is concentrated, and agricultural products are vital for society. Agriculture is the main supplier of food products, therefore the failures in the activities of agricultural producers seriously affect the living standards of the people. Since food products have a

feature to deteriorate in a fairly short time, their storage and accumulation in stocks is difficult, due to which their production should be carried out smoothly and in time, thus avoiding significant losses. Sixth, agricultural production is characterized by large areas and dispersion of production facilities, especially in such industries as plant growing, horticulture, and grazing. This complicates

technological control, so, delayed or poor-quality works become an additional source of risk. Seventh, agricultural producers, more than others, form their funds of reproduction by own products (seeds, fodder, etc.). This is important to consider when creating the necessary natural funds for the next production cycle.

Table 1 . Comparative characteristics of risk factors in agriculture and industry

Risk factor (criterion)	Sector				
	Agriculture Crop production	Livestock farming	Fuel production	Industry Electricity	Light manufac- turing
1. Seasonality	++	+	-	±	-
2. Storage and delivery impacts	++	+	±	-	±
3. Exposure to environmental impact	++	±	+	±	±
4. Influence of weather conditions	++	+	±	-	-
5. Impact of economic cycle	+	+	±	±	±
6. Influence of climate conditions	++	+	±	±	-

Significance of risk factor:
 ++ - very high;
 + - high;
 ± - moderate;
 - - no risk.

All of the above indicates that agriculture belongs to high-risk production. We performed a comparative study of agriculture and industry risk factors (Table 1). Our research showed a significant impact of risk factors on the performance of agricultural enterprises. This influence is more significant than in industry due to the climatic conditions and the impossibility of predicting the state of living organisms, which are the means and objects of labor in agriculture. Consequently, under market conditions, which are themselves sources of non-deterministic processes, the significance of studying the nature of risk, its factors and consequences is immense. The nature of the risks and their classification in agriculture is of great scientific and practical interest. The essence of the «agricultural risk» category is not sufficiently studied in scientific publications, its place is not determined in many existing risk classifications. According to A.P. Zadkov, in management decision making, risk is the choice of control parameters (control actions) that do not guarantee the fulfillment of goals in view of

the uncertainty (probabilistic nature) of business conditions. In relation to agricultural production, A.P. Zadkov said that one of the main causes of uncertainty here is the variability of weather conditions. They largely determine the features of technological processes during a particular production cycle (a year), the final results of production, and also affect other random factors (price conjuncture, reliability of technical equipment, etc.) (19). E.N. Krylatykh, like A.P. Zadkov, Identified specific causes of agricultural risk, considering it in the system of economic risks. He notes that any economic structure, including agro-industrial production, belongs to the category of probabilistic systems, subject to various risks (6). T.P. Lomakina considers agricultural risk as a category of risks of damage to an agricultural enterprise due to a disruption of the operation (7). A.A. Ter-Grigoryants defines the agricultural risk as a generalized characteristic of the process of preparing and making decisions in the face of uncertainty, when the optimal decision cannot be product of a chain of causation (14). The

study of the nature of agricultural risk allowed us to clarify and supplement this definition. In our opinion, agricultural risk is an indefinite probability of losses including invested money, labor, natural resources and income, due to the negative impact of natural, environmental, economic and other factors affecting the production process (3). There are various classifications of agricultural risk in the professional publications. One of the main studies in the field of agricultural risks is the book «Risk factor in agriculture» written by A.P. Zadkov. The author classifies risks according to the principle of identifying their areas, reasons (sources) of occurrence and ways to reduce them in agriculture (19). Yu.N. Voropayev divides risks in agriculture into justified and unjustified, subjective and objective ones (17). The authors of the monograph edited by K.S. Ternovykh highlight the following main criteria for classification of economic risks in the agro-industrial complex: source of risk, time of occurrence, risk area, its objectivity, possibility of regulating the degree of risk (16). By risk sources, the authors identify production risk, caused by the variability of the production processes, the unpredictable behavior of suppliers, customers and partners in various types of cooperation, the inability to fulfill contractual obligations and other factors. The occurrence of market risk is influenced by inflationary processes, possible fluctuations in interest rates, the volatility of the market price of shares of a given company relative to the average fluctuations of the market prices of shares of other companies and the volatility of output and commodity prices. Financial risk is associated with the financial security of productive assets. The risk of depreciation is manifested in the process of introducing new technologies. The disaster risk is the most unpredictable. The legal risk is directly caused by the uncertainty of government programs and instability of legislation as well as human risk factor. E.N. Krylatykh categorized risks by their sources (causes) (6). In his opinion, the examined sources of risks are characteristic for any branch of Russian economy, but in agriculture, there are still specific risk causes. These are the weather, the biological nature of the resources used, large areas of production.

The risk classification by A.A. Ter-Grigoryants is based on the functional area of risk manifestation. He identified the following risk groups: production risks, personal risks, commercial risks, financial risks (14). I.M. Mikhalenko divided the sources of risks in agriculture into three large groups: natural/climatic, market-oriented, and organizational-production (9). All this indicates that the risk in agriculture is multifaceted. Further enumeration and analysis of risk types and properties will only lead to the enumeration of different researchers' opinions, but will not give a definite answer to the key question - which classification is paramount. The existing approaches to systemizing risks, their theoretical argumentation, as well as their operational applications, are contradictory and antagonistic. It should be noted that none of these classifications focuses on environmental factors that could be the cause of economic damage in agriculture, the agro-industrial complex being one of the main users of natural resources. Studies have shown that the types and severity of the risks faced by farmers are largely dependent on the predominant method of organizing production, as well as on climatic, natural, economic, political and organizational conditions. A detailed research on the nature, sources, exposure and consequences of risk is necessary, first of all, to make the right management decisions. The problem of risk management arises not only when it is necessary to make individual managerial decisions, but also at day-to-day work, along with financial, personnel and quality management tasks. Management and risk are interrelated components of the economic system. Risk management allows enterprises to identify possible situations associated with adverse events, impeding the achievement of goals; to quantify the possible damage; to plan or implement the measures reducing risks to an acceptable level, etc. The agricultural risk management is based on the general theory of risk management. Therefore, the agricultural producers use basic principles and approaches, that can be divided into a number of groups. According to I.T. Balabanov, «risk management is a combination of strategy and techniques of

financial management in the entrepreneur's activities, i.e. risk management is a part of financial management» (2). According to N.N. Malashina, «risk management is the process of identifying the level of uncertainty (deviations in the predicted result), making and implementing decisions to prevent or reduce the negative impact on the expected results of stochastic factors and increase income in an uncertain economic situation» (8). In our opinion, the most appropriate definition is that by G.V. Tchernova: «... risk management is the process of making and executing management decisions minimizing the adverse impact of losses caused by random events on an organization or a person» (15). The risk and the management are interrelated components of the economic system. Agricultural risk management allows:

- identifying situations associated with possible adverse effects for the enterprise development
- quantifying the possible damage;
- planning and/or implementing the measures aimed at reducing risk to an acceptable level, etc

The management of modern agribusiness include the subsystem of operations management, which is a set of business practices concerned with the cost-effective use of material, labor and financial resources. From the standpoint of systems theory, the operational risk management system in agriculture includes two main elements: controlled object (agricultural risks) and subject of control (a set of means, methods and operations management bodies). The system of operations management, like any other system, is characterized by its goal, criteria for its achievement, functions ensuring targeted actions, a structure, i.e. composition of elements and their interaction in the process of managing the production process. The most significant factors determining the operations management system are: the organizational type of production, the specialization and size of the enterprise and its divisions, the level of cooperation development, renewability and variety of goods produced, a high level of mechanization and automation of production processes, etc. The main objective of the operational risk management is to ensure the

cost-effective implementation of agricultural businesses goals, as well as reducing the likelihood and amount of possible damage resulting from a risk event. Achieving the goal is the common result of various productive and economic activities of agricultural enterprises. Based on the systematization of the experience of many agricultural enterprises, we offer the following methods of operational risk management for agriculture:

- environmental methods: environmental monitoring and environmental audit; agrochemical ecotoxicological expertise; application of meteorological forecasts; zoning of weather conditions
- economic methods: creation of reserve funds (self-insurance); use of risk map; production diversification; flexible alternative planning; imitation;
- technological methods: use of soil-protective technologies; expansion of variety assortment of crops; substitution of resources; compliance with the principles of crops rotation; use of modern agricultural equipment; use of crops that build up the soil; use of erosion-preventing farming systems;
- organizational methods: environmental education of personnel (trainings, seminars, etc.); goals adjustment; staff development.

Currently, one of the main methods of managing external risks, caused by negative effects of external factors beyond a person's control, is insurance. Minimizing the severity of possible damage, insurance allows stabilizing the farmers' incomes. Self-insurance is the creation of reserves that an enterprise can use upon the risk event. For example, spatial diversification in agriculture is manifested in the level of land-use compactness. The smaller land plot is, the less money is spent on equipment, transportation of workers and transportation services. Limiting implies restricting both the sales of manufactured products and the expenditure to a certain limit. For agriculture, this measure is particularly relevant. Thus, for example, only a part of seed material, the marginal rate of which is planned in advance, is used for the further production of crops. Flexible and alternative planning includes the development of contingency plan in certain risk situations, reducing the degree of uncertainty and having

a positive impact on the activities of the enterprise. An adapted management system is also one of the most important factors allowing to reduce economic risks. It includes certain approaches leading to a sustainable income generation, and, above all, a flexible production structure adapted to risk situations. For example, forming the structure of cropped areas, it is advisable to take into account intercropping, e.g. winter wheat and winter rye, winter wheat and leguminous plants, the combination of which would improve the crop yield at a reduced barley cultivation. Flexible technologies of production, storage, processing of agricultural products, which permit to change decisions in varying weather conditions, to prevent or mitigate the adverse effects of the external environment, to ensure an efficient use of biotechnical resources, play an important role in ensuring the stability of agricultural production. There is an objective need for a system of material and financial reserve funds, including internal reserves to effectively manage risks. The results of agrochemical research can serve as the base for the development of a fertilization system and measures to improve soil fertility and crop yields. They are used to determine the needs and plan the use of fertilizers on the basis of

economic computations, to develop recommendations on design and estimate documentation, intensive technologies of crops cultivation, crops cultivation on irrigated land and for other purposes at all levels of agricultural production. Environmental monitoring is a system of long-term observations of environmental elements in space and time, aimed at studying the dynamics of their change, determining the causes and sources of negative impact, developing and implementing measures to improve the ecological situation, and rational use of natural resources (10). Thus, the above-mentioned methods of operational risk management in agriculture will ensure constant performance of agribusinesses in a rapidly changing economic environment, which will result in an increased food security in both the country and the region (1). Synthesis of achievements of modern theory of organization and management of production creates the scientific basis for the operational management systems where the organization of agricultural production, planning and management are organically linked.

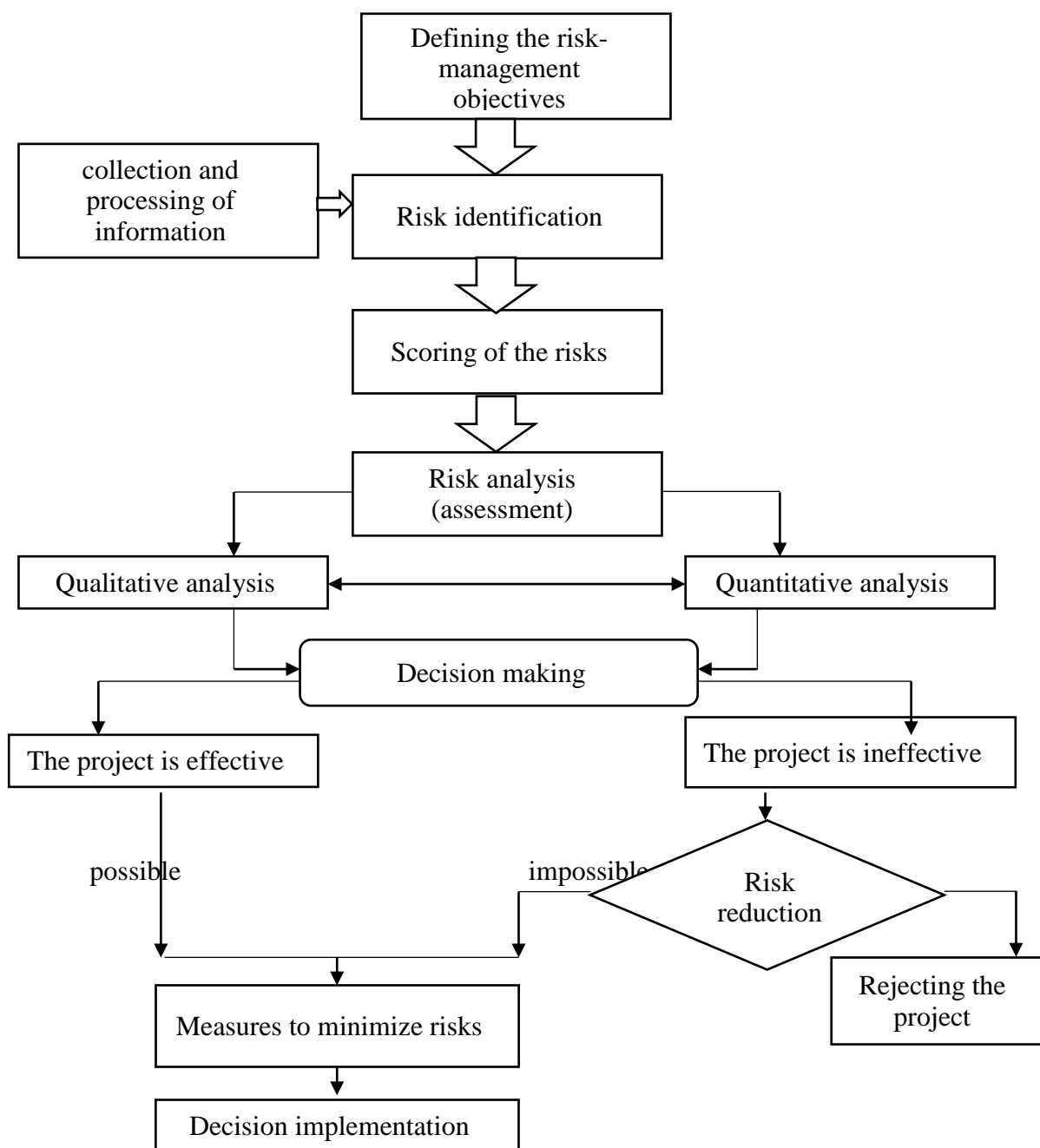


Fig. 2 – Risk management scheme

The programme for managing both risks and environmental-economic problems should be based on the assessment of technological, technical and economic risk, enterprise environment and opportunities, current regulatory framework, economic and mathematical methods, marketing and other research. The mechanism of effective management under uncertainty and risk conditions should be based on a clear algorithm. Analysis of scientific publications (18). allowed us to develop a generalized model of the risk management process (Fig. 2). The objective of different stages of the risk

management system is to identify measures that reduce the risk to “acceptable” level and ensure the monitoring of consequences of their implementation. At the first stage it is necessary to determine the objectives of risk assessment. They should be in line with the objectives of enterprise management, the attainability of which is verified as a result of risk assessment procedure. The next step is the collection and processing of information. Information must meet certain requirements: be reliable, complete, objective, meaningful for research. Risk identification is the third stage. The main purpose of this stage is to

determine the composition (list) of negative (adverse) events causing environmental degradation and directly or indirectly (through this deterioration) causing economic damage to the object under consideration (15). Thus, an event is considered as negative, firstly, if there is a real possibility of its occurrence and, secondly, its manifestation can cause real damage to the object. In addition, at the identification stage, it is supposed to make a justification of the conclusion about the possibility (or impossibility) of causing real damage to the object under consideration. The next, fourth step is risk ranking. At this stage it is necessary to determine the most common risks of the enterprise. To reduce the number of situations studied, a matrix of risks involved in a particular project (decision) of the enterprise should be built. Risk analysis (fifth stage). The purpose of risk analysis as one of the most difficult stages of risk management is to provide potential partners with information to make decisions about the feasibility of the project and the possibility to undertake measures against losses. Risk analysis is usually divided into two types: qualitative and quantitative (13). The sixth step is risk assessment. It should be noted that the risk assessment represents the stage, at which managers determine its quantitative characteristics: the probability of occurrence of adverse events and the possible amount of damage. After the possible risks have been evaluated, a decision is made on whether to accept or reject the project (the seventh stage). If the risk level is acceptable, then the risk is accepted, if not, then a number of risk reduction measures are developed. N.P. Tikhomirov, I.M. Poravny et al. distinguish the following system of measures regulating the risk management and the conditions for its implementation. In terms of their composition, they are divided as follows (15): regulatory measures; administrative; economic measures and technical measures. The final stage of risk management is the control over the execution of the decision. Monitoring of individual stages of risk analysis is carried out during environmental monitoring, examination of existing facilities – sources of danger, design and construction of new facilities, licensing, inspections and some others. An enterprise

may reject a risk-related decision in the course of its commercial and production operations; the above method is applicable only to very serious and large risks. The decision to avoid certain business risks can be made, either at the preliminary stage of decision-making, or later, by refusing to continue the activity, if the risk is higher than it was initially foreseen. As a conclusion, we have to note that a well-developed risk management programme is becoming an objective necessity, especially in the market relations. At the same time, the solution of this problem should be based on a complete and reliable assessment of the processes occurring in the agro-industrial complex of the region, and in the future it will be a prerequisite for the development of organizational and economic measures to ensure more efficient and less risky farming. In this regard, an in-depth and systematic analysis and assessment of environmental and economic risk factors is quite appropriate.

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